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GOETHE ON NATURE & ON SCIENCE

by

SIR CHARLES SHERRINGTON
O.M.

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&
ON SCIENCE

CAMBRIDGE
UNIVERSITY PRESS
LONDON: BENTLEY HOUSE
NEW YORK, TORONTO, BOMBAY
CALCUTTA, MADRAS: MACMILLAN

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GOETHE ON NATURE
&
ON SCIENCE

BY

SIR CHARLES SHERRINGTON, O.M.

THE PHILIP MAURICE DENEKE LECTURE
DELIVERED AT
LADY MARGARET HALL, OXFORD,
ON THE 4TH MARCH 1942

CAMBRIDGE
AT THE UNIVERSITY PRESS
1942

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PRINTED IN GREAT BRITAIN

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GOETHE ON NATURE
&
ON SCIENCE

TWO facts we may, at outset, recall about Goethe. That a great poet he was yet life-long an ardent student of the sciences of Nature. And this other, that with him—and not merely as usage of the German language—Nature was always Nature with a capital N. The thoughts of few men can be more adequately on record than are Goethe's, biographically and autobiographically, in his formal works and in his correspondence. We may look therefore to exceptional opportunity for knowing what this Nature with a capital N stood for in his mind.

He would have wished us to know. He was disappointed that his contemporaries did not pay more attention to his thoughts on Science and on Nature. He remarked once to Eckermann: 'I do not attach importance to my work as a poet, but I do claim to be alone in my time in apprehending the true nature of colour.' Again, in the pillage of Weimar, his main anxiety was for his scientific work in manuscript. That loss, he said, would be irreparable.

We know something of his reaction to Nature in his childhood. We are told that, as a boy, during the family's frequent theological discussions, he would sit silent, but, afterwards, in his bedroom contrived an altar from a music-stand, placed on it minerals and flowers, and arranged, for crowning it, a flame to be lit by a burning glass from the rays of the freshly risen sun. Clearly, a child's act of worship. Paganism we may think, but how did the boy come by paganism in the bosom of a zealous Lutheran family?

In his manhood, scientific studies of Nature lay always near his heart. Let me use the term science here in brief to mean the sciences of Nature. Goethe's science was wide and reached to both physics and biology.

In physics, his best-known work—he called it 'optical' —was on colour. A feature of this work was its disagreement with that fundamental observation known as the decomposition of white light into coloured lights on passing through a glass prism. He rejected the decomposition of white light into spectral colours. He said he could not confirm it. The story is told that his attempt to repeat it was hurried and faulty. That he looked at the window through the prism and expected to see a field of spectral colour right across. Whereas he saw only some narrow coloured side-fringes. Be that as it may, he was distrustful of the whole doctrine.

He was for the most part a careful and patient observer. In this same matter of coloured and white light, he found himself likewise unable to confirm that white could be arrived at by combining colours. Here his difficulty lay in interpretation of the result. He could obtain in that way a pure grey. To the argument that a pure grey *is* a pure white of weak intensity and that all he had to do to get a brighter white was to strengthen the coloured ingredients, he rejoined, 'Ein hundert graue Pferde machen nicht einen einzigen Schimmel' [a hundred grey horses do not make one white one]. When his younger acquaintance, the philosopher Schopenhauer, sent him in manuscript the successful confirmation of both of these Newtonian experiments, Goethe remained still a sceptic.

In following Goethe's science we are helped by his having left on record a number of principles which in his view should govern scientific observation. One of them is that observation must be kept as simple as possible, and for that reason should eschew apparatus. Prominent in his objection to the prism experiment was that the prism introduced heaven-knew-what complications. Essential for scientific observation was '*Anschaulichkeit*'—perhaps here best translated by 'obviousness' or 'naked perceptibility'. Anschaulichkeit could dispense with mathematics—it avoided resort to mathematics. In Goethe's view that was an advantage. He was not himself equipped in mathematics, and he regarded the role of mathematics in science with extreme distrust. Mathematics led to the introduction of propositions which were not truly contained in the original proposition. It had brought calamitous confusion to optics—the opposition of two rival theories, the corpuscular theory and the wave theory of light. As to simplicity, he did not seem to recognize that the use of apparatus in scientific observation is mostly for simplifying the conditions. Nor again, that the application of mathematics in science is a main means toward obtaining Anschaulichkeit. Nor again, that an hypothesis such as the corpuscular or the wave theory of light is merely a way of suggesting tests by which to test further.

Goethe's objections to the physicists' treatment of colour went, however, beyond this. His own treatment of the subject touched other issues still. Colour was, in science, Goethe's Lieblingsthema. He was, it is well to remember, of that type which the psychologist classes as 'visual'. That is, his memories, his fancies, his dreams, used visual imagery. Thus, to induce sleep a device he had was to visualize a seed gradually growing into a plant. His predilection for the eye is expressed by his remark 'gegen das Auge ist das Ohr ein stummer Sinn'. Further, in following Goethe's study of colour we are helped by remembering that in studying colour he was studying what Locke had termed a secondary quality of matter, meaning by that a quality which, if no sentient beings were, would cease to exist. The distinction is artificial to us to-day, but in Goethe's day was less obviously so; and Goethe himself seems to study colour as if colour itself existed as such in nature. He could not, as it were, divest himself, during his scientific work, of the practical habit we all have of accepting the external world in terms of our senses and colour as part of it.

Goethe seems scarcely to have entertained, or at least not constantly kept in mind, such a distinction. The late Rudolf Magnus gave much attention to Goethe's work on colour, and he argued that there were times when Goethe did not succeed in bearing in mind that the physical, although it correlates with the psychical, does not necessarily resemble it. Thus, Goethe, because to his judgment the colour 'green' seemed a mixture, argued that the light which gives it must be a mixture of two lights, blue and yellow. Now, it is a well-observed fact that an indistinguishably similar sensation of 'green' can be got in several physical ways. For instance, it is given by admixture of two different physical lights, or by a mixture of three different physical lights, or again by one kind of simple light alone.

The sensation given in these several different ways is just one and the same to the mind. Indeed, observations of this kind are the basis of Thomas Young's theory—put forward in Goethe's time—which accounts for the whole gamut of our colour sensations by three sets of structures or substances in the eye corresponding with the sensations red, green and violet, hence called primary colour sensations.

Rejecting as he did the ordinary physical view about the production of colour, what did Goethe put in its place? It is at times a little difficult to follow him in this. But it leads us into the heart of some of his thinking about Nature. As mentioned, he is out for avoidance of complication, and for Anschaulichkeit, as of the first importance. In connection with them comes the choosing of an '*Ur-phänomen*'. The conception of the Ur-phänomen is of importance to Goethe's view of science. The term is perhaps best translated 'bedrock phenomenon'. He had the idea that there are in Nature certain occurrences at once accessible to our observation nakedly and uncomplicatedly, and also specially profound and significant. An example is the magnet. 'Der Magnet ist ein Ur-phänomen, das man nur aussprechen darf, um es erklärt zu haben.' The magnet's attraction and repulsion 'zusammen deuten auf eine Scheidung, auf ein Entzweien, das beim Magnet sein Entgegengesetzten, seine Totalität, sein Ganzes wieder sucht'. Basic phenomena, such as that of the magnet, though restricted in number, are yet scattered widely over the range of operations of Nature. Ordinarily in Nature the fundamental is obscured from us by accessory and secondary phenomena which cluster round it. The accessory factors lead analysis astray. But the Ur-phänomen lies open in naked simplicity to our observation. It is perceptible by our senses and we instinctively apprehend it. Science cannot, and never will, resolve it further. But we can build up from it. It is the ultimate Anschauliches in Nature. Its simplicity is part of its cogency. In geology he finds the Urphänomen to be 'granite'—because granite lies at the base of the Earth's crust—the very heart of the mountains is made of it, but past granite 'my Spirit's wings can go no further'.

In colour, he took his starting-point from what he regarded as its Ur-phänomen. That was this. If a little spirits-of-wine containing a trace of soap be added to a glass of water, the clear water becomes clouded. Held up against the light, that is, seen by light coming through it, the water looks yellowish. On the other hand, lit by the same light but from the front, and with a black screen behind to cut off transmitted light, the clouded water looks bluish. That is, when the light by which we see it comes through it, the water, with its faint uncoloured turbidity, appears yellowish. When, using the same white light, the light is reflected from it, there is a bluish colour. Probably most of us have noticed a similar effect when a little milk is added to water. A richer emulsion, for instance undiluted milk, is fully opaque to light. We have then for transmitted light complete extinction, darkness. And to reflected light a surface which, like the familiar appearance of milk, is white because fully reflecting. This final degree of clouding, complete opacity, was for Goethe 'vollendete Trübe'. This Ur-phänomen, like that of the magnet, had the character of exhibiting diametrical opposites, white and black, brightness and darkness. And between these polar opposites stretched the series of the colours.

This phenomenon according to Goethe was simplicity itself. It needed no apparatus. It invited no sophistication at the hands of mathematics. It was immediately understandable by anyone. It was Anschaulichkeit pure. With this as his Ur-phänomen Goethe developed his 'Doctrine of Colour'—'Die Farbenlehre'. Its teaching was: We see through media. Colour is ultimately an affair of the cloudinesses of media. Goethe had so-called 'opal-glasses' prepared, which gave by reflected light a bluish tint, by transmitted light a yellow or orange. He drew confirmation and illustration of the theory from an incident he met with, which was this. An old oil-painting, of a man dressed in black, was being cleaned with a wet sponge. At once the black coat looked blue, but when dry was black again. The surface sheet of varnish clouded by moisture and seen by reflected light against the black ground looked blue. Goethe took pleasure in observing how his theory explained many of the sights which delighted him in Nature. The harvest moon through autumnal mist flamed like a blood orange. Then there was the roseate glow of clouds at sunrise and sunset, and above that glow the bar of heavy purple. Then again the blueness of the hills of the far landscape. Again, the immaculate blue of the summer zenith, which is the thin gauze of reflected light from the unclouded air above us seen against the intense black of cosmic space. Goethe is so happy about all this that he breaks into verse.

Wenn der Blick an heitern Tagen
Sich zur Himmel's Bläue lenkt,
Beim Siroc der Sonnenwagen
Purpurrot sich nieder senkt;

Da gebt der Natur die Ehre
Froh, an Aug' und Herz gesund,
Und erkennt der Farbenlehre
Allgemeinen, ew'gen Grund.

Of course, rejecting the prism experiment and its explanation of colours as he did, he had yet to account for how it was that the prism gives its fan of rainbow colours. His argument was this. A glass mirror as a reflector has the disadvantage of returning two images, one from the front surface and a second from the back. He thought of them as coloured and he ascribed their colour to cloudiness as usual. The glass prism also gave two reflections. But there the green was a difficulty. He met that by arguing that the lateral displacement of the second reflection made the blue in it overlap the yellow of the first reflection. The green was therefore a mixture just as Goethe's mental judgment declared that green always was.

It is hardly worth while following him further in this. Certain points however, of larger interest, regard his scientific outlook in general. One is that which he drew of an *a priori* distinction of certain phenomena of Nature as being peculiarly fundamental and uncomplicated. This appears to-day—if it did not then—oddly artificial. Nature, as he himself often said, is 'ein Ganzes', and all her phenomena inextricably intermeddle. 'Flower in the crannied wall, I pluck you out of the crannies, and if I could understand you all in all, I should know what God and man is.' That seems nearer to Nature than was Goethe's conception of the Ur-phänomen. Goethe's choice of the colour production by suspensions looked at or through, as an Ur-phänomen, is not one which I think we can endorse as simple. It hardly has simplicity. There are in it a number of variable factors not altogether easily ascertained or controlled, variables which Goethe himself did little to control. Goethe never set out to disentangle the observation physically. For him it was a simple unanalysable fact to be taken as it stood. That was his attitude toward light itself. Light was a something which as to its nature human intelligence could not hope to understand. That was indeed the root of his objection to the prism experiment.

The prism experiment, he considered, made the mistake of presuming to enter upon an insoluble question, the actual nature of light.

> Möget ihr das Licht zerstückeln,
> Farb' um Farbe draus entwickeln,
> Oder andre Schwänke führen,
> Kügelchen polarisiren.
> Dass der Hörer ganz erschrocken
> Fühlet Sinn und Sinne stocken.
> Nein! es soll euch nicht gelingen.

He thought the observations and arguments of the physicists presumptuous to the point of absurdity, by reason of their underrating the inscrutability of Nature. The physicists' experiments seemed to him an instance of the foolish rushing in where angels fear to tread. There seemed here in Goethe an almost constitutional inability to appreciate the physicist's point of view. Perhaps it was partly his distaste for mathematics. Be that as it may, Goethe's approach to the scientific study of Nature was an opposite to that of the physicist. The opposition between them consisted not so much in thinking that by one of them natural science could reveal Nature and by the other not. The two differed as to what kind of knowledge of Nature science *could* reveal. Thus, Burtt's *Metaphysics of Modern Science* tells us that, in Newton's view, the utmost which can ever be expected from our scientific study of Nature is an exact mathematical formulation of natural processes. Newton therefore like Goethe felt that only a certain modicum of knowledge of Nature was ever to be expected from science. The physicist's view of the potentiality of natural science had not less humility and austerity than had Goethe's own; it perhaps had more. The difference between them lay rather in the kind of modicum of knowledge which each could expect to attain.

Goethe has remarked on the role of genius in Science. After pointing out that a scientific experiment should amount to asking a question of Nature, he says the role of genius in Science lies in the choosing a right question to ask, and that that gift rests on the revelation to scientific genius of which among Nature's phenomena are Ur-phänomenen —key phenomena. Goethe said that that knowledge comes to the scientific genius intuitively, in a flash. It is that intuition which confers on genius a creative power in Science. It enables such a genius to stand, as it were, beside Nature and participate spiritually in her activity as she creates. I think it is fair to suppose that when he speaks of scientific genius he has himself in mind; and surely that final statement lights up intimately to us Goethe's idea of Nature—a Goddess more than Olympian in kind.

His research into colour was an enquiry into her ways—leaving light, her instrument, to be taken for granted as inscrutable. He went on to observations in which he could be freer still from all preoccupation with the physical notion of light. We all have experience of how, after looking at a strong colour and then at a grey surface we see for a moment the contrast-colour of the original. On a bright morning a red rose will repeat itself in green on the gravel path. Goethe studied the occurrence of these after-images—he called them 'geforderte Bilder'. As a result he arranged the colours in a ring of six—three which he considered simple colours and three intervening which he considered were mixed ones. In this ring the colour of the after-image always stood directly opposite to the colour which induced it. This result he likened to the Ur-phänomen of the magnet. It showed Nature striving to satisfy the longing for totality when forced into polar opposites. This phenomenon is known in physiology as 'successive contrast'. There is also 'simultaneous' contrast, which Goethe was perhaps the first to study. A sample is this. Two sheets of paper, one red, one green, placed out on the table in a good light; a bit of pure grey paper laid on the red sheet looks green, on the green sheet looks red. Goethe said of this that again it shows the striving of Nature for totality. Red and green are polar opposites, the calling forth of one of them by itself is an 'Entzweiung' of the 'Ganzes' in one part of the field, 'Totalität' makes the other appear even where not called up in the field. Goethe remarked of this phenomenon that it occurred unconsciously. Later, when Helmholtz was working at the physiology of seeing, he on the contrary regarded the contrast as an erroneous 'judgment'. Later work here fully confirmed Goethe—it is conscious in the sense that we can experience it, but it arises from quite unconscious mental factors. It dogs the painter all the time—and Goethe was as skilled as a painter in observing it. He speaks of the waves of a green sea adding purple to their moving shadows. He enjoyed talking of colour with artists though it is true he had not contact with any of the greater painters. Goethe, we have seen, was predominantly a 'visual'.

This predominance of the visual in him is very evident in his scientific studies, dealing with the twin kingdoms of living nature, plant and animal. It was in the shapes assumed by life that Goethe found his deepest scientific interest—an interest which never staled throughout his life. Aristotle is known as the founder of the study. But Goethe gave it the name by which it is now universally known, morphology—the study of shape, meaning by that living shape. The subject attracted him early. When a Law student at Strasburg he preferred the company of the students who were doing anatomy, because they talked 'shop' even at meals. He frequented the dissections. The human body is of course a treasure-house of living form. Later, at Weimar, the shapes of trees and leaves fascinated him. In the riper period of what we might still call his youth, that pivotal experience came to him which is known as the Italian journey. His 'Sturm und Drang' period, the period of Werther's 'Leiden' and of 'Götz', was then over. He went by way of the Brenner and of Garda. He found Italy an enchanted land. As he descended the southern alpine slope the wealth of flower and leaf and stem was something he had never witnessed or conceived. At Padua he entered the Botanical Garden. The palms there were in blossom. Their fans illustrated a scientific thought he had entertained. Their shapes presented a series ranging from extreme to extreme with all grades of transition. This revived in him an impression that leaf-form was in a state of flux.

Superintending State forestry and agriculture at Weimar, as he did, Goethe was conversant with the botany of his time. He would take with him the young Dietrich on excursions for collecting plants. The Linnean system of classification was everywhere in use. Young Dietrich knew it well. Goethe had difficulty in memorizing the names. He blamed this to the system. His poem to Christiane Vulpius complains:

Dich verwirret, Geliebte, die tausendfältige Mischung
Dieses Blumengewühls über dem Garten umher;
Viele Namen hörest du an, und immer verdränget
Mit barbarischem Klang einer den andern im Ohr.

Botany was an old study, but not until the seventeenth century had it learned the meaning of the flower of the plant. There had arisen a desire to catalogue, and arrange in order, all the kinds of plants that were. The assumption of the time was that the kinds around us were still as at the Creation of the world. Goethe in due course however had noticed for himself such differences between specimens of the same kind that he doubted that fixity of species which the Linneans took for granted. He thought specific form might be in a state of flux. That was his interest in the palm-leaves at Padua. The continual change, which he suspected was going on in plant-form, Goethe attributed to the influence of external conditions—soil, light, warmth, moisture, etc. Therefore partly it was that on descending the alpine slope into Italy from the north the luxuriance of the flora came to him as a verification of the thoughts in his mind. He said, If this is what a smiling landscape, and rich soil and sun, can do, how impressionable must be the seeds such influences work on!

The naturalist Lamarck was putting forth somewhat similar views in Paris. Both Goethe and he dissented from the Linnean 'frozen' view of species, though it was orthodox. Lamarck is as prosy a writer as one can find. Goethe, on the other hand, sang his thesis aloud.

> Und umzuschaffen das Geschaffne
> Damit sich's nicht zum Starren waffne,
> Wirkt ewiges, lebendiges Tun.
> Und was nicht war, nun will es werden,
> Zu reinen Sonnen, farbigen Erden,
> In keinem Falle darf es ruh'n.
>
> Es soll sich regen, schaffen, handeln,
> Erst sich gestalten, dann verwandeln;
> Nur scheinbar steht's Momente still.
> Das Ewige regt sich fort in allen!
> Denn alles muss in Nichts zerfallen
> Wenn es im Sein beharren will.

In reading Goethe's science we are never left long without a reminder of his tendency, when speaking of Nature, to personalize her. As he described this state of instability, of flux, which Nature's living work exhibited to him, the collateral notion grew upon him that, at back of it all, were ideals—for instance that, while creating leaves, Nature kept in mind an 'ideal' leaf. Concrete leaves, in all their vast variety, were variants of an ideal leaf. His fancy pictured an 'ideal' plant, and Nature visualizing it, and calling forth from the stem of it a manifold of side-growths, of leaves, petals, sepals, stamens, each and all of them just modifications of the ideal leaf. The very wrappings of the seed, the shell of the nut, the flesh of the apple, were all modifications of the leaf. As efficient causes actually producing these he supposed phases of growth due to restraint and freedom of the movement of the sap.

We cannot follow this further now. Suffice to say, it is no part of botany to-day. Goethe however regarded it as a botanical discovery. In his enthusiasm he took occasion, almost at the beginning of his acquaintance—which ripened into close friendship—with Schiller, to dilate on this theme to him. Schiller heard him out, and then, to Goethe's surprise, said: 'Das ist keine Erfahrung; das ist eine Idee.'—'That is not a fact: it is an idea.' Time has confirmed Schiller's remark. Goethe's view has gone the way of unsupported theories.

Goethe studied animal life also. An anatomical finding which he came across was that the incisor part of the upper jaw in man is separate from the rest of that bone, as it is in animals. It was a detail, but Goethe's interest was greatly excited by it. Not that he was in the least the type of naturalist who loves detail for detail's sake. On the contrary, in science as in so much else, he followed large views. But on his coming across this old vestigial partition of the human face-bone we find him writing to Herder: 'I have found—not gold or silver—but something which gives me unspeakable delight. I was comparing with Loden the human and animal skull, and came on the clue.' His delight lay in the detail as a clue, one clue the more, bringing man and animals together, tracing them to be one. 'Ich habe es in Verbindung mit deinem Ganzen gedacht.' Goethe loved to feel himself, and ourselves, one with Nature, and all Nature one. As for the observation as a discovery, it was in fact already known. It had been published a few years before by Vicq-d'Azyr in Paris, at the Académie des Sciences (1779).

Again in the animal world it is individual form which most attracts him—he classified even the shapes of clouds. As among plants the flowering plants so among animals it is the crowning group—the back-boned—which specially engages him. The back-bone is a row of bones, the vertebrae. Jointed to the front end of the row is the skull. Goethe surmised that the skull itself is vertebrae continuing those of the back-bone. Goethe's musings conceived creative Nature—'die Göttin'—creating the back-boned animal keeping an ideal vertebra in mind. He exclaims: 'How far from the tortoise to the elephant, and yet the gap is bridged entirely by intermediate forms! Because the whole series belongs to one ideal type.' The Nature-goddess, in shaping every individual of each great animal type, works to the pattern of a 'vorschwebende Idee'. This is a transcendental anatomy. That the skull is a set of vertebrae, an anatomist, Oken, put forward independently of Goethe, and this had a following among anatomists for a time. But with the progress of anatomy it became discredited, and in the 80's of last century Thomas Huxley rejected it finally.

For Goethe, Nature in her creating of living things continually produced fresh shapes, variants of certain primal patterns—patterns which themselves were never yet on land or sea, or in air. These ideal patterns the creative principle set before itself. They were, so to say, Platonic ideas in the mind of the creative mind, namely in that of the Nature-goddess, a cosmic presence. Goethe drew joy from the contemplation of the boundless productivity of this Being. Yet, deifying her though he did, he traced limits to the powers she possessed. He took credit to himself for the discovery of a 'law' which he called that of the 'correlation of parts'. It controlled even the Nature-goddess. It decreed that nothing could be added new to an animal-shape except at the cost of taking something away. Thus, the long body of the snake is obtained by depriving the creature of limbs. The relatively large limbs of the frog are got at the expense of shortening the body. Even the ateliers of Olympus are therefore under the rule of necessity. The deciphering of this law of correlation so pleased him that he broke into song about it.

Siehst du also dem einen Geschöpf besonderen Vorzug
Irgend gegönnt, so frage nur gleich, wo leidet es etwa
Mangel anderswo, und suche mit forschendem Geiste,
Finden wirst du sogleich zu aller Bildung den Schlüssel.
Denn so hat kein Tier, dem sämmtlich Zähne den obern
Kiefer umzäumen, ein Horn auf seiner Stirne getragen,
Und daher ist den Löwen gehörnt der Ewigen Mutter
Ganz unmöglich zu bilden, und böte sie alle Gewalt auf,
Denn sie hat nicht Masse genug, die Reihen der Zähne
Völlig zu pflanzen und auch Geweih und Hörner zu
treiben.

These verses are scarcely poetry. Their theme we must think does not fully admit of their being poetry. That Goethe himself should judge the theme capable is poignant evidence of how greatly in earnest he was about it. But this 'law' of his deciphering, has no place in science to-day.

Were it not for Goethe's poetry, surely it is true to say we should not trouble about his science. His science is as science not important. But it has real importance owing to the light it throws on Goethe the poet, and on his conception of Nature. He thought about Nature over and over. He abounded in originality. His enthusiasm as an observer of Nature was great. But a new fact he met with was apt to send him forth on a flight of imagination into the unknown. Creative genius in literature as he was, in science that same genius longed to create, and could not always content itself waiting for further experiments and more knowledge. A golden rule in science is to follow experiment where possible, even where the imagined seems extremely probable. Goethe, though devoted to science, seems to us hardly of the scientific temperament. He had not, in this respect, for instance, along with the urge to discovery the sublime detachment of the great scientific thinkers, their passionless urge.

To other men than Goethe, Nature might appear a system of material principles, but not to Goethe. To him she appeared far more and far other than that. Where he seems to use her as metaphor, I would think, it often is not metaphor at all. He thought of her, for one thing, as the mysterious creative power immanent in an immortal world—the embodiment of a divine activity. Thus it was that he criticised what he took to be the physicist's view of light. Light, he said, as to its ultimate nature is obviously unknowable by us. A glance at mid-day is enough to show us that. To think of it as a series of travelling particles or waves is simply an attempt to fit it for, to fit it into, mathematics. That is a mistaken aim. It is artificial. It creates confusion even for the physicists themselves; hence some say 'particles', others 'waves'. It reduces the splendours of sunrise and sunset to mathematical formulae—mere mathematical formulae. It is no approach to the reality of light, the attribute of Nature.

Und was sie deinem Geist nicht offenbaren mag
Das zwingen sie ihr nicht mit Hebeln und mit Schrauben.

Goethe seems sometimes, as we read him, to be looking over the shoulder of his goddess while she creates. When creating plants she has an Urpflanze floating within her sight. When fashioning animals she follows the 'vorschwebende Idee' of a 'Typus'. This creatress which he pictures begins to assume to our eyes the figure of a great productive pagan goddess. There is in her little tenderness or charity. 'Sie baut immer, und zerstört immer. Ihr Schauspiel ist immer neu, weil sie immer neue Zuschauer schafft.' This being is with Goethe no occasional presence. She is a dweller with him, and always she is a joy to him. He draws strength from contemplating her. His adoration of her approaches ecstasy. The paean of praise adventures no criticism. Traits he depicts in her may to us seem unlovely, but they are not so to him.

Sie spendet die reichen Lebensgaben umher, die Göttin;
Aber empfindet keine Sorge, wie sterbliche Frauen, um
ihrer Geborenen
Sichere Nahrung: ihr ziemet es nicht.

She is too lofty to heed their suffering, though her offspring. To do so would not become her. Clearly this Goethe is not a christian Goethe—whether a greek or a gothic, I must leave.

To Goethe, worshipping her, a crowning glory of her is her endless zest-in-life, an inexhaustible *joie-de-vivre*, an inextinguishable creative fury. 'Leben ist ihre schönste Erfindung, und der Tod ist ihr Kunstgriff viel Leben zu haben.' And here it is that we meet Goethe paying the price for invoking in this anthropomorphic guise his concept of Nature. It makes the scientific question 'how' no longer enough for him. He is no longer content until he tells us the 'why'. Nature for him has come to be a *dramatis persona* in the world-drama. And so he has to show us the 'why' of what this *persona* does. 'Der Tod ist ein Kunstgriff mehr Leben zu haben.' And again, 'Sie gibt Bedürfnisse, weil sie Bewegung liebt.' Profound sayings these, but they are not Science. Natural Science does not ask, let alone attempt reply to, such 'why's'. But men do ask them, about each other, and about the gods. They are therefore instructive for us when we would ask as to Goethe's conception of Nature.

For one thing she was to Goethe a goddess of universal beauty—sometimes strange beauty, but always beauty—beauty of a blindingly radiant being. To perceive her in all her beauty was for Goethe perhaps the supreme of all human privileges, and to ally our forces with hers consciously for our allotted span was the utmost of all which is vouchsafed to us:

> Im Grenzenlosen sich zu finden
> Wird gern der Einzelne verschwinden,
> Da löst sich aller Ueberdruss:
> Statt heissen Wünschen, wildem Wollen,
> Statt lästgem Fordern, strengem Sollen,
> Sich aufzugeben ist Genuss.

My statement, we see, did not resume his fully. For him man's privilege is to merge with Nature consciously for an allotted span, and, then, as further privilege, to merge with her unconsciously. This theme is akin to that of the last stanzas of Shelley's 'Adonais'. Its treatment by Goethe seems of another and a greater order.

In formal philosophy, we know that friends urged on Goethe, more than once, the reading of Kant's *Kritik der reinen Vernunft*—then relatively new—and that Goethe could not get through with it. Possibly the obscurities of its style were peculiarly tiresome to a great master of style. Of philosophers it was Spinoza who had Goethe's ear. Goethe's approach to Nature was not materialistic. Nature was not for him matter working itself. That view possessed no appeal for him. He found it intolerable—'a Cimmerian grey'. If we have to label Goethe's philosophic attitude toward Nature, may we not say 'pantheism'—not, as has been said of Spinoza's, a mathematician's pantheism, but a poet's pantheism.

He peopled the natural world with powers which had idealised human shapes. There were Seismos, and Chaos, and some which he called after the old Ionian thinkers upon Nature. These Powers he would invoke. They spoke with each other, and to him. Nature resembled not too distantly a vast Brocken-scene in which the supernatural worked the natural, with Faust as spectator. Were they demigods, these Powers? They were at least of some category of the divine. His scientific experiments sought to know what might be known of their ways. But he felt that in great part the vast Cosmos, spread limitlessly around him, was a something inscrutable to man. Yet the presiding genius of the sum total of these Forces and Powers operating it, Goethe sublimated to the likeness of a divinity, a goddess, Nature—more than Olympian. Goethe's hymns to this Nature make together one song of unalloyed delight. Goddess, she was an embodiment of *joie-de-vivre*. Her *joie-de-vivre* for Goethe was contagious. A source of her joy lay in the prodigality of her own fertility. Spinoza has been styled 'God-intoxicated'. So, Goethe, in this worship of Nature, might be styled 'Nature-intoxicated'. Nature, whose activity was immanent in us and around us, was a riot of perfection; she was glorious and faultless.

Let us note that here Goethe's thought runs wide of the thought of to-day? It is alien to modernity. His goddess ceaselessly throwing forth for pure enjoyment new forms of life seems to us to have in her a trace of the wild-wood, of the savage. Goethe's exultation in her utter immensity, and the ingenuity of her creativeness, strikes, to us hearing it to-day, a somewhat lonely note. To-day has no unstinted praise for this goddess. Goethe's rich gift of fancy revelled in her and all she did. The thought of to-day does not. To-day's view of Nature is more austere, more anthropomorphically critical. To it, the view of Goethe has a touch of thoughtlessness, even to the point of lack of pity. He is blind to Nature's broadcast sowing of suffering. Moreover, to him no hint has been vouchsafed of a present pregnant with a different future, the great theme which the modern naturalist never forgets. Goethe envisages nothing of an evolution which seems—and not least in evolving man—to display a trend, not merely toward new shape and greater complexity, but 'upward'. That has no part in Goethe's dream. But a younger poet was already saying, by the mouth of the hoary Titan, 'Lo, at our heels a fresh perfection treads'.

Aristotle, devotee of 'Nature', conceded of her that she has in her more of the hateful than of the lovable; though Aristotle was no squeamish critic. To Goethe on the other hand nothing in Nature seemed abhorrent. Antithesis to Goethe, the Dean of St Patrick's found the body, and all its ways, disgusting, and Swift, when he scolded men, rubbed their noses in that. But Goethe's healthy, robust, delight in Nature accepted everything. That Nature sowed and reaped vast harvests of pain all over the Earth casts no cloud on Goethe's looking round and enjoying her. Zest-for-life is, we know, life's most ruthless destroying angel. With progress of knowledge of Nature the fact emerges only the more clearly. Yet turning to Goethe it would seem unknown. Toward the end of his long life, he is singing:

Ihr glücklichen Augen
Was je ihr gesehen,
Es sei wie es wolle,
Es war doch so schön!

Of the blight of suffering on Nature, he lived as if unaware. He might reply, 'Of what use to lament over what I cannot alter?' Yet it was deeply distressing to David Hume, though no versed naturalist. Goethe's great younger contemporary sang of it, 'It spoils the singing of the nightingale'. And indeed it forms part of that acknowledged problem, the existence of pain in our world. Yet Goethe says of his Nature-goddess: 'Die Menschen sind alle in ihr, und sie in allen. Mit allen treibt sie ein freundliches Spiel'—Ein freundliches Spiel? The wolf-pack in pursuit! The leopard at the throat of the deer! The cancer growing! Ein freundliches Spiel?—the words ring like irony. Goethe's view of Nature in this respect remains an enigma and it is another view than to-day's. It is, perhaps, too sane for to-day.

But of course by reason of this insouciance Goethe's worship of Nature takes all the more joyous a note. I call it worship. I think it amounted to worship—not for a moment is it materialistic. Matter was for him the mere vehicle for the play of mighty immaterial forces, superhuman activities, which the creative fancy, dominating him, endowed with personalities. He remarks somewhere: 'I have at times to resort to pantheism to satisfy my being.' Supreme among these superhuman divinities of his was Nature. He wrote in his Annalen, when he was sixty-two: 'With me, a pure, deep, innate and constantly-followed conception has been the view that God is inseparably within Nature, and Nature inseparably within God, and this idea has been at the basis of my whole existence.' To anthropomorphize the forces of Nature is, we are sometimes told, a trait belonging to primitive society. Be that as it may, in Goethe it was a transcendent mental trait, gifted with epic powers. Besides the eternal poetry of direct personification of special aspects of Nature, it extended to the creation of beings representing whole categories of Nature, and finally to that of universal Nature—the creation of demigods and a god.

For him surely, the Nature he turned to, and addressed so often, was no impersonal principle, no causal concatenation of material forces. Rather, it was a numinous presence, immanent in Earth and Sky, operating the gates of birth and death. We have heard him call her a goddess and as such he depicts her. 'Unmasked and unwarned,' he says, 'we are caught up by her into the whirl of her dance. She carries us along until we are tired and drop from her arms. She herself is tireless. Her present is eternity. Always is she a whole, and yet never is she complete. The game she plays with all is a friendly game. The more we take from her the better she likes it. But she loves herself. Her study is herself, and her own pleasing. She invites us to share her enjoyment of herself. She loves illusion. Those who will not share her illusions she punishes as a tyrant would punish. Those who accept her illusions she takes to her heart. To love her is the only way to approach her. With her love-potion she can heal the woe of a lifetime. She has brought me here; she will take me hence. I trust her. She will not hate her own handiwork.'

Is not such metaphor as this more than metaphor? Is he not uttering his faith? Profound truths are in it. And profound pathos. On one of those rare occasions, when he spoke of religion in regard to himself, he said that the Deity as such was to him inscrutable, but that one aspect of Deity was not so, Nature. And then, too, we have the invocation—for we may call it that:

Welt-seele komm uns zu durchdringen,
Dann mit dem Weltgeist selbst zu ringen,
Wird unsrer Kräfte Hochberuf,
Teilnehmend führen gute Geister,
Gelinde leitend, höchste Meister,
Zu dem der alles schafft und schuf.

A cry of content to be one with Nature! That thought is comfortable to him—more than comfortable, it is welcome. The thought that whether alive or lifeless he is inescapably and for ever a part of Nature—one with her. This, it would seem, is what sustains him. He draws from it his salve for existence, his balsam wherewith he would heal death itself.

Und so lang du das nicht hast,
Dieses: Stirb und Werde!
Bist du nur ein trüber Gast
Auf der dunklen Erde.

Surely, supremely said! And from it we can judge a little what was in his thought in the lines—and they moved him when, toward the end, they suddenly met him again—

Über allen Gipfeln
  Ist Ruh.
In allen Wipfeln
  Spürest du
Kaum einen Hauch;
Die Vöglein schweigen im Walde.
Warte nur, balde
Ruhest du auch.

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